

[54] **SUPPORTING CUTTER ASSEMBLIES FOR MULTIPLE GROOVING OF PAVEMENT**

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[58] Field of Search **299/39-41, 89; 51/176, 206.5, 207**

[56] **References Cited**

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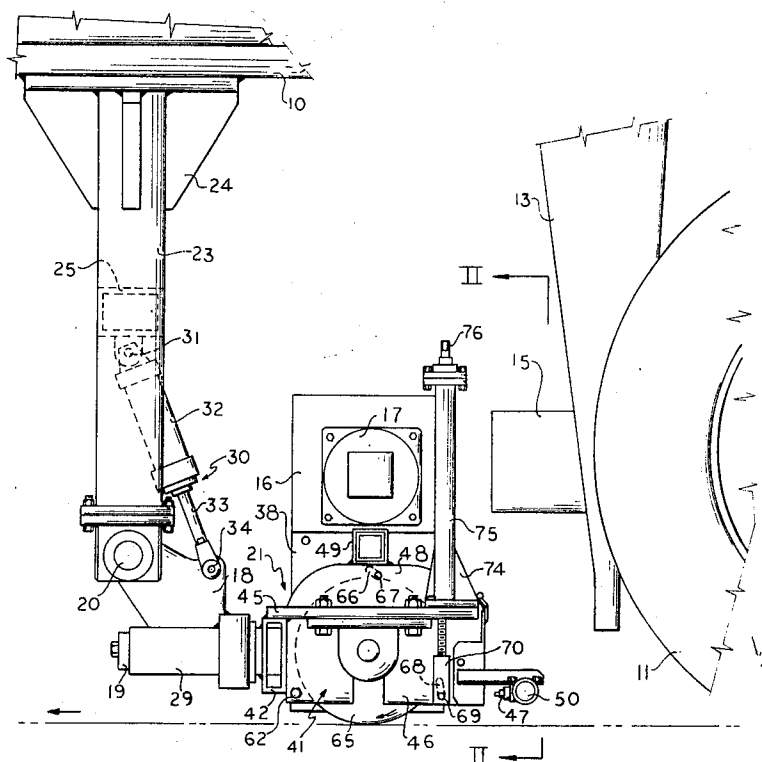
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[57] **ABSTRACT**

Vehicular apparatus for use in multiple grooving of pavement is provided with generally cylindrical cutter assemblies having cutter heads with laterally spaced blades rotatable to groove pavement when in contact therewith. Each cutter assembly is mounted to be raised and lowered uniformly and also to be tilted relative to the vehicle frame. Adjustable depth wheels at each end of a cutter assembly control the groove depth.

13 Claims, 6 Drawing Figures



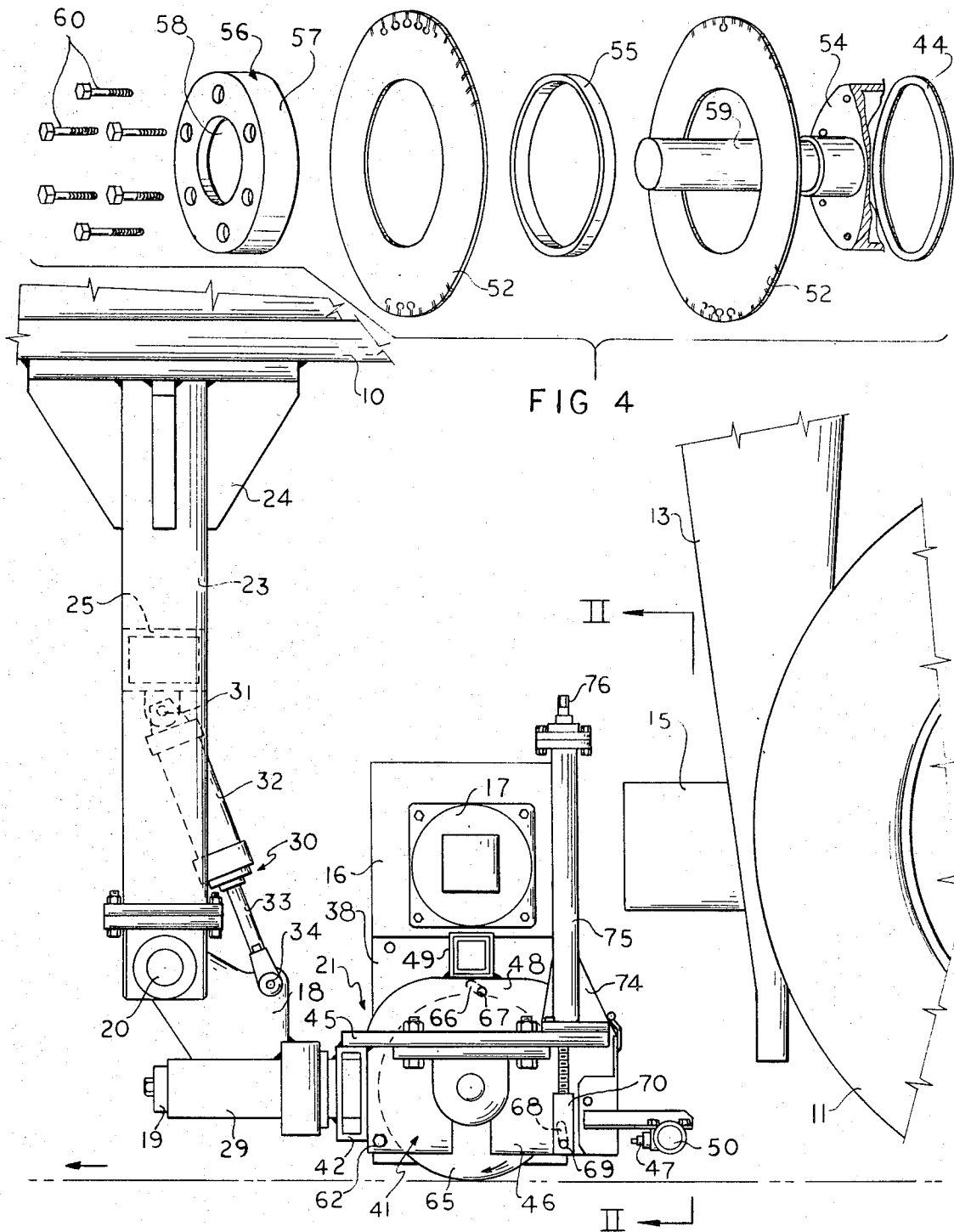
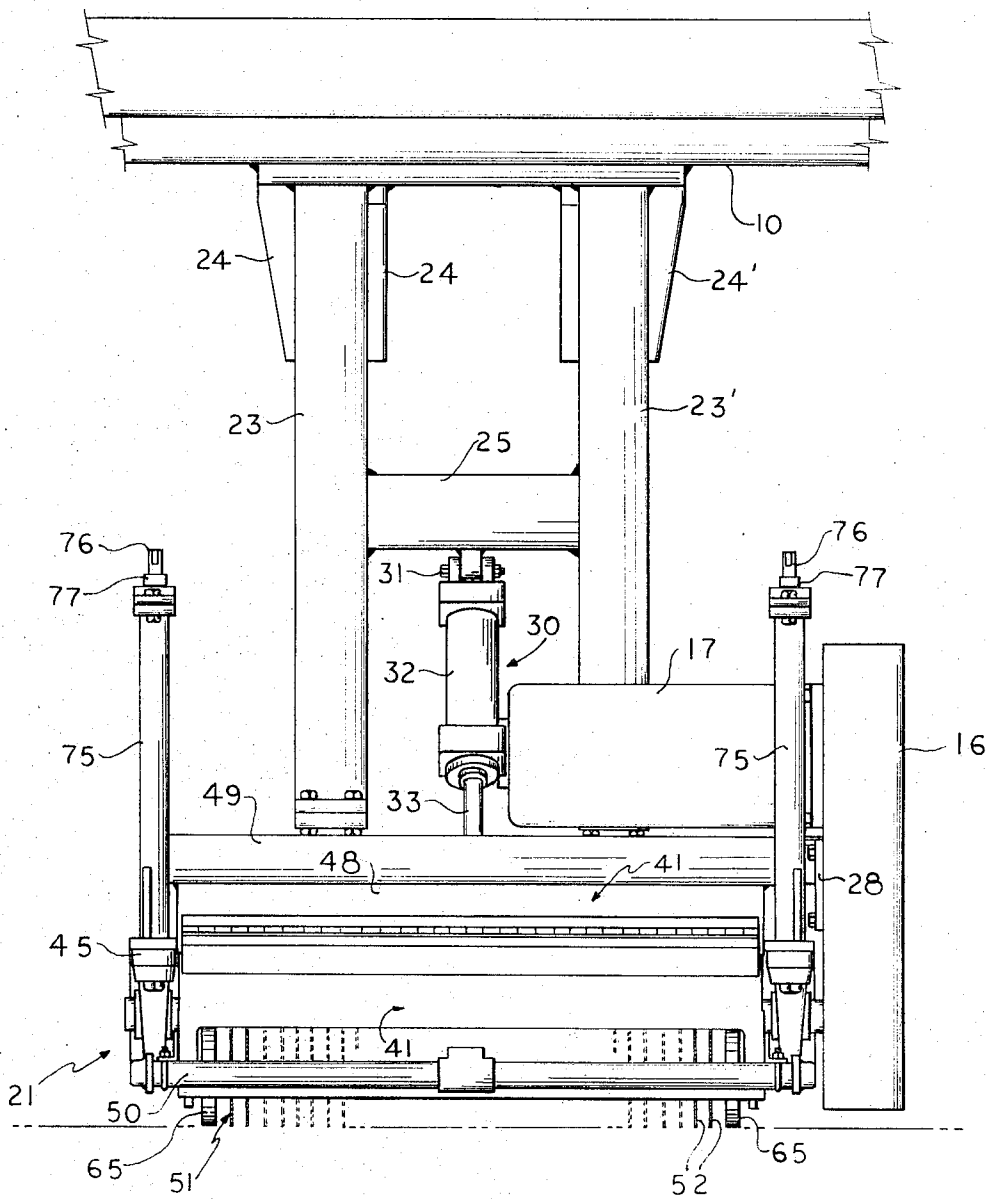
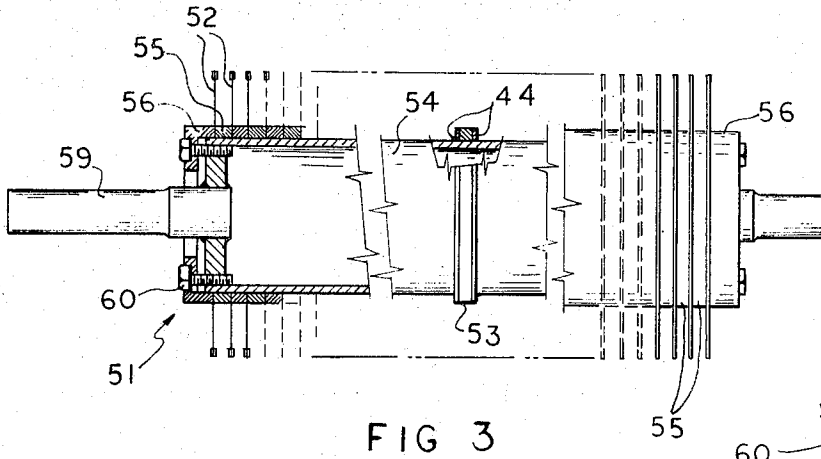
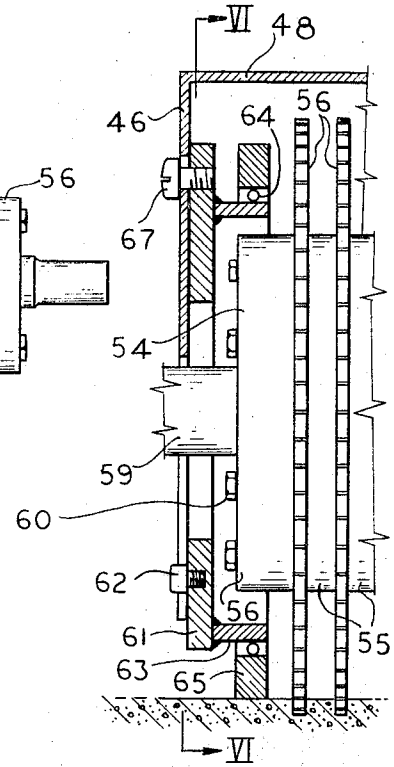
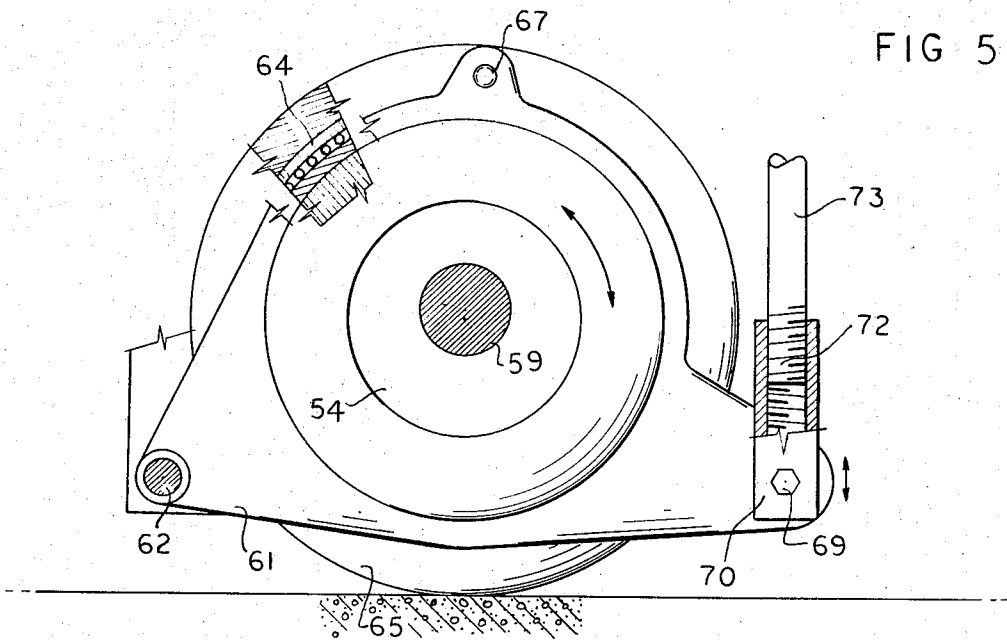


FIG 1

FIG 2





SUPPORTING CUTTER ASSEMBLIES FOR MULTIPLE GROOVING OF PAVEMENT

Reference is made to my similarly entitled copending patent application, Ser. No. 212,253 filed concurrently herewith, and the benefit thereof is claimed for the present application.

This invention relates to grooving of pavement, particularly multiple grooving thereof to improve traction thereon, especially when wet.

Vehicular apparatus useful for multiple grooving of pavement is known. However, existing designs thereof are relatively inconvenient, inefficient, and not adequately controllable in such use.

A primary object of the present invention is improved mounting of cutter assemblies in apparatus for multiple grooving of pavement.

Another object is improved construction of a cutter head for such a cutter assembly.

A further object is improved depth control for such cutter heads.

Other objects of this invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams.

FIG. 1 is a side elevation of pavement grooving apparatus of this invention, including a cutter assembly and supporting elements in relation to a vehicle frame;

FIG. 2 is a rear elevation, partly cut away and on an enlarged scale, of the cutter assembly and some related elements of FIG. 1, taken at II—II thereon;

FIG. 3 is a fragmentary rear elevation of the cutter head of the same cutter assembly;

FIG. 4 is an exploded perspective view of an end portion of the apparatus of FIG. 3;

FIG. 5 is a rear elevation, partly in section, of such end portion in assembly with adjacent elements; and

FIG. 6 is a side elevation of the apparatus of FIG. 5.

In general, the objects of the present invention are accomplished in vehicular apparatus for multiple grooving of pavement, including a vehicle frame, support means carried by the frame and adapted to support a cutter assembly having a generally cylindrical cutter head and means for rotating the cutter head to groove pavement in contact therewith, by means of an improved cutter assembly, improved support thereof, and improved depth control therefor. Such features of the invention are to be considered both individually and together.

FIG. 1 shows vehicle frame 10 very fragmentarily from the side, and FIG. 2 from the rear. The frame is on wheels, being supported on wheel assemblies 11 (one shown here), in part mounted on mounting members 13 (one visible) depending from the frame, and is propelled in part by wheel drive motor 15 carried by mounting member 13. The steering mechanism, as well as most of the drive mechanism, is hidden behind the wheel assembly; it is not shown in this view (or otherwise) inasmuch as such mechanisms may be conventional and are not claimed as part of the present invention. The rest of the frame and the other wheels are omitted as superfluous to the illustration and this discussion.

Cutter assembly 21 comprises generally cylindrical cutter head 51 (FIG. 2) and related elements. The supporting means for the cutter assembly comprises laterally spaced posts 23, 23' joined by transverse member 25 and depending from respective flanged anchoring

structures 24, 24' secured to the frame. Transverse horizontal shaft 20 is mounted pivotally through the lower end of the post and secures it to supporting flange 18, which carries tilting support assembly 29, itself containing fore-and-aft horizontal shaft 19 upon which the cutter assembly is adapted to tilt. Means for raising and lowering the cutter assembly as a whole comprises extensible-retractable means 30, including cylinder 32 and piston rod 33 protruding therefrom; the cylinder is joined at one end to transverse member 25 via transverse horizontal pivot pin 31, and the piston rod is joined to supporting flange 28 by parallel pin 34.

Shroud assembly 41, which is generally semi-cylindrical, appears only fragmentarily end-on in this view. It is stiffened by transverse box member 42 along its front edge and is flanked at its opposite ends (one visible here) by end pieces 45, extending rearwardly from fixed connection with the transverse box member. The shroud assembly generally surrounds cutter head 51 and comprises partially bifurcated side skirts 46 and bonnet 48, stiffened by overlying transverse box member 49. Also visible at the far end of the assembly are drive motor 17 for the cutter head and intervening gearbox 16, which is secured by flange 28 to one end of transverse box member 49. Shroud assembly 41 is open at the rear to receive lubricating and cooling water from jet-like openings in distributor pipe 50, which extends from side to side to the rear of cutter assembly 51 and carries jets 47. As water supply or recovery forms no part of this invention, although it may be used therewith, no more of the plumbing is shown or described.

FIG. 3 shows cutter head 51, partly cut away to conserve space and eliminate needless repetition. The head comprises cylindrical arbor 54, which is surrounded by plurality of rotary cutter blades 52 suitably spaced laterally from one another and retained removably thereon. The arbor has fixed peripheral stop 53 flanked by pair of removable shims 44 midway of its cylindrical surface. The combined width of the stop and shims (optional) conveniently equals the spacing width of blades 52 on the arbor. Adjacent blades other than the pair immediately flanking the stop are so spaced from one another by one or more ringlike spacers 55. At each end the assembly of spacers and blades is retained on the arbor by bolted end cap 56, which fits onto the end of the arbor.

FIG. 4 shows an end portion of cutter head 51 in exploded perspective view. The other end (not shown) is similar but with shorter axle. End cap 56 has central opening 58 therein to accommodate axle 59 extending from the end of the arbor. Each end of the arbor is threaded appropriately to receive cap-retaining bolts 60. Each end cap has peripheral flange 57, which fits over the end of the arbor and abuts endmost blade 52. For simplicity only two blades 52 with intervening spacer 55 plus shim 44 at the right are shown. The cutting blades normally comprise ringlike discs of steel slotted radially inward at intervals along the peripheral edge to which are bonded segments of abrasive material, such as tungsten carbide with diamonds embedded therein. Removal and replacement of worn or broken blades is accomplished readily upon unbolting the end cap, as suggested in this view. It will be understood that, where the end of the arbor would extend beyond the pavement to be grooved, one or more blades at the end may be replaced by spacers (with or without one

or more shims) so as to provide the desired overall width.

FIGS. 5 and 6 show details of means for adjusting or controlling the depth of the cutter blades relative to the pavement to supplement the fragmentary showing thereof in FIG. 1. Shroud skirt 46 has support plate 61 for depth wheel 65 along its inside wall. The support plate is pivoted to the front portion of the skirt by bolt 62. The depth wheel is mounted rotatably by bearing assemblies 64 on collar 63 affixed to the inner wall of the support plate. As shown in FIG. 1, slots 66 and 68 in the skirt accommodate respective bolts 67 and 69 threaded into the support plate. The latter bolt also engages end piece 70 of adjusting linkage for the depth wheel. The end piece is internally threaded to receive substantially vertical threaded end 72 of adjusting rod 73, the upper portion of which is surrounded by cylindrical casing 75 whose lower end abuts the upper edge of end flange 45 and is bolted thereto. Top end 76 of the adjusting rod protrudes from the casing and is squared off to receive a wrench or other adjusting tool. Rotation of the top end of the adjusting rod in a clockwise direction raises (and in a counterclockwise direction lowers) the depth wheel, thus increasing (or decreasing) the depth of cut.

Operation of this apparatus is readily understood. While the vehicular apparatus is driven to the working site, the cutter assembly is stowed in its raised position by retraction of the extensible-retractable means. Once on the site and in position for a cut, the adjusting rods are (or have been) preadjusted to set the depth wheels for the proper depth of cut. The head is started rotating at cutting speed (and water is supplied thereto) before contact with the pavement. Then extension of the retracted means lowers the cutter assembly into cutting position with the cutter head juxtaposed to the pavement to be grooved. The depth wheels at each end average out pavement irregularities. The tilting head adjusts to the lateral gradient of the pavement, and the adjusting rods can be reset from time to time if required by blade wear.

Any necessary disassembly or reassembly of the cutter head is simplified by the end cap and arbor stop construction. Presence of the stop facilitates assembly without cocking of the blades. Clamping of the blades in place is simplified by use of the end cap and shot bolts securing it to the end of the arbor, rather than by long bolts through the blades themselves. Shims are used only when the desired groove spacing in the pavement exceeds the stop width, which itself equals a customary minimal spacing, such as one half inch. It is convenient to have sets of spacers corresponding (singly or in pairs, etc.) in width to common groove spacings (e.g., $\frac{3}{4}$ inch, $\frac{7}{8}$ inch, 1 inch, $1\frac{1}{4}$ inch, $1\frac{1}{2}$ inch) and to use shims only alongside the stop. Of course, the groove width is determined by the width of cutting edges on the blades (usually from about $\frac{1}{10}$ inch to $\frac{1}{4}$ inch).

Although the apparatus of this invention has been shown and described in a specific embodiment, modifications may be made therein, as by adding, combining, or subdividing parts, or by substituting equivalents, while retaining advantages and benefits of the invention, which itself is defined in the following claims.

I claim:

1. In vehicular apparatus for multiple grooving of pavement, including a vehicle frame, support means

carried by the frame and adapted to support a cutter assembly having a generally cylindrical cutter head, and means for rotating the cutter head to groove pavement in contact therewith, improved support means comprising a post carried by the vehicle frame, first pivot means mounted on the post and having a horizontal axis parallel to the axis of the cutter assembly, and extensible and retractable means pivotally interconnected at the opposite ends thereof to the post and the cutter assembly for extending and retracting to lower and raise the cutter assembly.

2. Pavement grooving apparatus according to claim 1, the assembly including second pivot means having a horizontal axis perpendicular to the axis of the cutter head, the cutter head being carried by the latter pivot means for tilting thereabout.

3. Pavement grooving apparatus according to claim 2, including at the respective ends of the cutter assembly adjustable depth-of-cut means mounted on the support means and adapted to ride in contact with the pavement surface at a level variable from that of the peripheral extent of the blades at their lowermost edge.

4. In vehicular apparatus for multiple grooving of pavement, including a vehicle frame, support means carried by the frame and adapted to support a cutter assembly having a generally cylindrical cutter head, and means for rotating the cutter head to groove pavement in contact therewith, improved depth-of-cut means comprising at and surrounding but spaced radially from the respective ends of the cutter head a wheel mounted on the support means to ride in contact with the pavement at a level variable from that of the peripheral extent of the blades at their lowermost edge, and means so mounting the wheel.

5. Pavement grooving apparatus according to claim 4, wherein the mounting means for the depth wheels includes a horizontal pivot parallel but eccentric to the axis, a plate supported thereon for limited adjustment thereabout, bearing means on the plate for mounting the wheel rotatably, and means for securing the plate in any position of adjustment to fix the level of the wheel and thereby the level of the peripheral extent of the blades at their lowermost edge.

6. In vehicular apparatus for multiple grooving of pavement, including a vehicle frame, support means carried by the frame and adapted to support a cutter assembly having a generally cylindrical cutter head, and means for rotating the cutter assembly to groove pavement in contact therewith, improved support means comprising a post carried by the vehicle frame, first pivot means mounted on the post and having a horizontal axis parallel to the axis of the cutter assembly, means interconnecting the cutter assembly to the pivot means for raising and lowering thereof about the horizontal axis, extensible and retractable means interconnected at the opposite ends thereof to the post and the cutter assembly for extending and retracting to lower and raise the cutter assembly; an improved cutter head comprising a cylindrical arbor, a peripheral stop on the arbor at a location intermediate its ends, a plurality of removable cutting blades fitting on the arbor at each side of the stop, a plurality of removable spacers fitting on the arbor, each pair of adjacent blades at either side of the stop being separated the width of the stop by at least one such spacer intervening therebetween; and improved depth-of-cut means comprising at the respective ends of the cutter assembly a wheel mounted on

the support means to ride in contact with the pavement at a level variable from that of the peripheral extent of the blades at their lowermost edge, and means so mounting the wheel and including a horizontal pivot parallel but eccentric to the axis, a plate supported thereon for limited adjustment thereabout, bearing means on the plate for mounting the wheel rotatably, and means for securing the plate in any position of adjustment to fix the level of the wheel and thereby the level of the peripheral extent of the blades at their lowermost edge.

7. Pavement grooving apparatus according to claim 6, including an improved cutter head comprising a cylindrical arbor, a peripheral stop on the arbor at a location intermediate its ends, a plurality of removable cutting blades fitting on the arbor at each side of the stop, and a plurality of removable spacers fitting on the arbor, each pair of adjacent blades at either side of the stop being separated the width of the stop by at least one such spacer intervening therebetween.

8. Pavement grooving apparatus according to claim 6, the cutter assembly including second pivot means having a horizontal axis perpendicular to the axis of the cutter, the cutter being carried by the pivot means for tilting thereabout.

9. Pavement grooving apparatus according to claim

6, wherein the depth wheels are open centrally to accommodate an axle shaft protruding from the cutter head.

10. Adjustable depth-of-cut means for rotatable blades extending from the surface of a cutter head of a height-adjustable cutter assembly in pavement grooving apparatus comprising an open-centered depth wheel exceeded in diameter by the cutter blades but exceeding that of the head surface and surrounding the axis of rotation of the cutter head adjacent an end of the cutter head, means mounting the wheel eccentrically relative to the axis, and means for adjusting the degree of eccentricity thereof and thereby determining the depth of cutter penetration into pavement when the wheel is contiguous therewith.

11. Depth-of-cut means according to claim 10, wherein the depth wheel surrounds an end of the cutter head in spaced relationship therewith and spaced also from the nearest cutter blade.

12. Depth-of-cut means according to claim 10, in duplicate, located at opposite ends of the cutter assembly.

13. Depth-of-cut means according to claim 12, wherein the respective depth wheels surround the corresponding ends of the cutter head.

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